

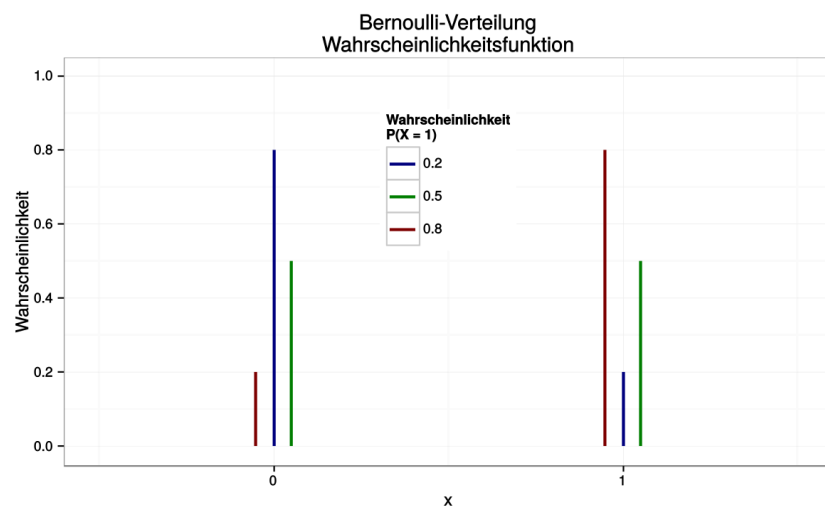
Bernoulli Distribution

The bernoulli distribution is the simplest discrete probability distribution. It represents the probability distribution of a random variable that has exactly two possible outcomes: success (with probability p) and failure (with probability $1 - p$). It is used to model binary outcomes, such as coin flip or a yes/no questions.

$$0 \leq p \leq 1$$

$$q = 1 - p$$

$$K = \{0, 1\} \quad \text{where: } P(\text{success}) \Rightarrow k = 1, P(\text{fail}) \Rightarrow k = 0$$



$$PMF = P^K * (1 - P)^{1-K}$$

$$P(K = 1) = P^1 * (1 - P)^{1-1} = P$$

$$P(K = 0) = P^0 * (1 - P)^{1-0} = (1 - P) = q$$

Mean of Bernoulli Distribution

$$P(X = 1) = p$$

$$P(X = 0) = q$$

$$E(X) = P(X = 1) * 1 + P(X = 0) * 0$$

$$E(X) = p * 1 + q * 0 = p$$

Median of Bernoulli Distribution

$$\text{median} = 0 \quad \text{if } q > p$$

$$\text{median} = 0.5 \quad \text{if } q = p$$

$$\text{median} = 1 \quad \text{if } q < p$$

Mode of Bernoulli Distribution

$$\text{mode} = q \quad \text{if } q > p$$

$$\text{mode} = p \quad \text{if } q < p$$

Variance of Bernoulli Distribution

$$\text{Var}[X] = E[X^2] - (E[X])^2$$

$$E[X^2] = \sum X^2 P(X = x) = 1^2 * p + 0^2 * q = p$$

$$\text{Var}[X] = p - p^2 = p(1 - p) = p * q$$